(12) UK Patent Application (19) GB (11) 2 254 646 (13) A

(43) Date of A publication 14.10.1992

(21) Application No 9206388.2

(22) Date of filing 24.03.1992

(30) Priority data
(31) 9106737 (32) 28.03.1991 (33) GB

(51) INT CL5
E21B 31/107

(52) UK CL (Edition K)
E2A ACMF A190 A558
U1S S1761

(56) Documents cited
None

(58) Field of search
UK CL (Edition K) E2A ACMF
INT CL5 E21B 31/107, F16B 7/00 7/10 7/14 7/22, F16L 21/00 21/08 27/12 37/00 37/08 37/12
Online database: WPI

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(54) Locking tool e.g. a wire line jar for downhole operations

(57) A tool 1 has inner and outer co-axial members 2, 3 which are capable of relative axial positional adjustment and a locking mechanism 6 for locking the members 2, 3 in an adjusted position. The mechanism 6 comprises a tooth-and-groove formation 8 on the exterior surface of inner member 2, an aperture 9 extending through the thickness of outer member 3 to expose part of formation 8, an element 10 which can be releasably inserted into aperture 9 to engage with the exposed part of formation 8 and a sleeve 11 which is axially movable to overlie the aperture 9 and retain the element 10 captive therein.

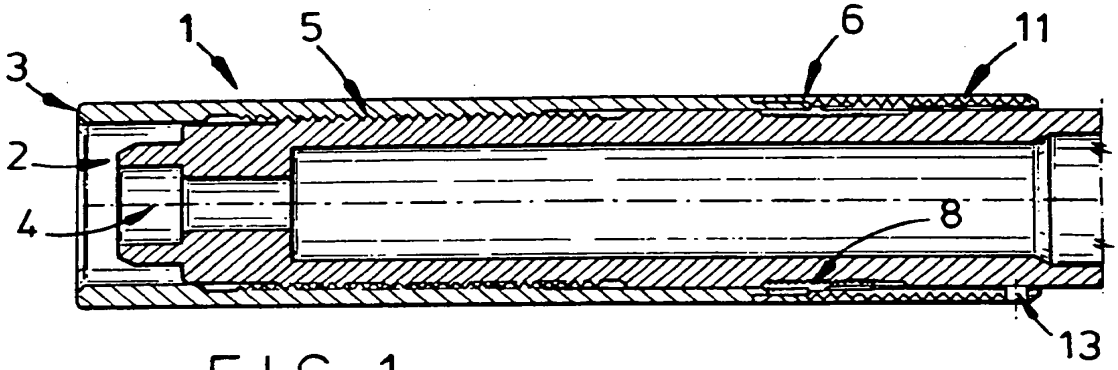

FIG. 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

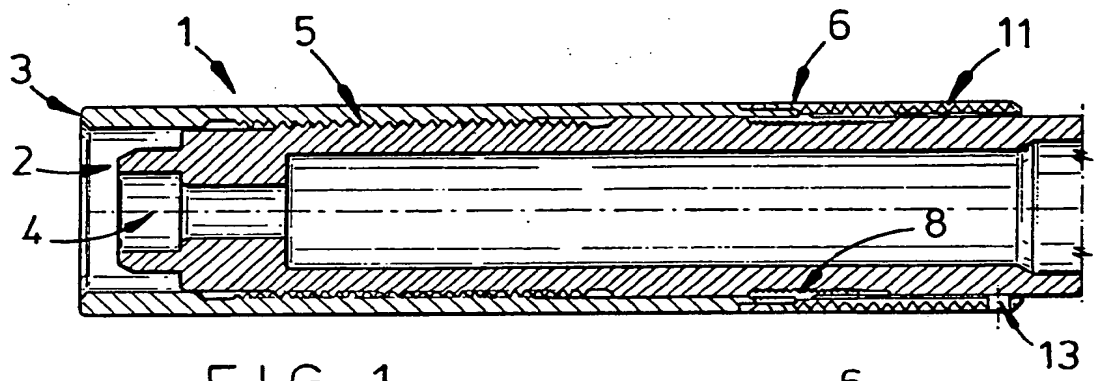

FIG. 1

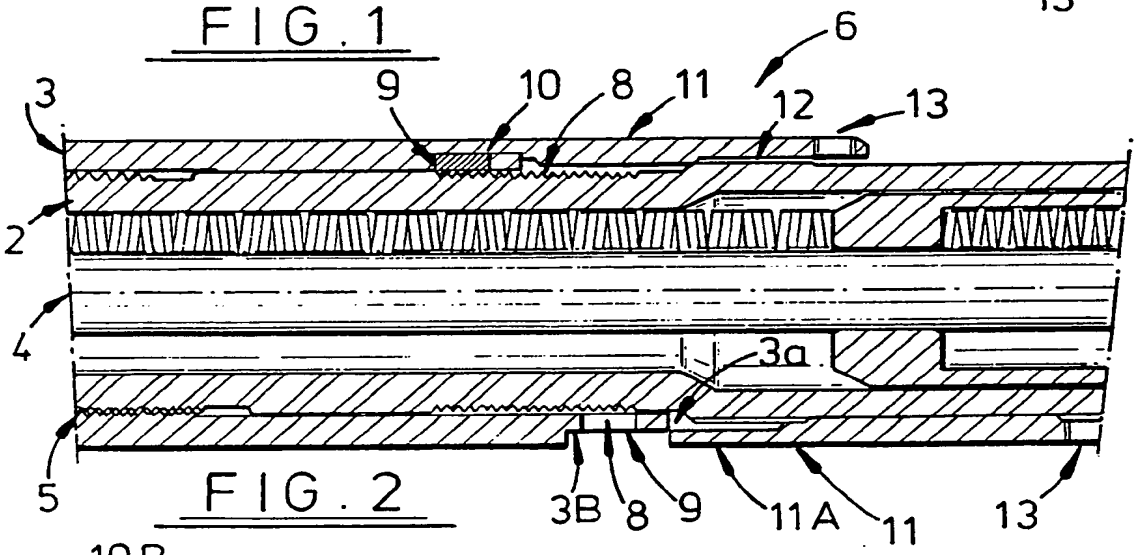

FIG. 2

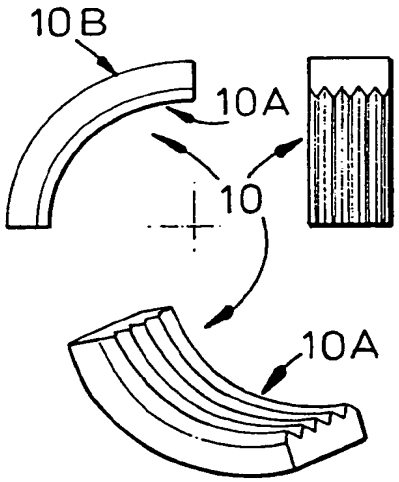

FIG. 3

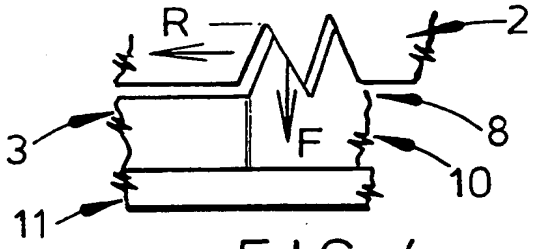

FIG. 4

LOCKING TOOL

The present invention relates to a tool having inner and outer co-axial members which are mounted so as to permit relative axial positional adjustment, and to a locking mechanism for locking the members of the tool in a specific position.

Tools of this type find use in many applications; for example in downhole oilfield operations where the tool may take the form of a wireline jar.

According to the present invention there is provided a tool having inner and outer co-axial members which are mounted so as to permit relative axial positional adjustment, comprising a mechanism for locking the members of the tool in any one of a number of specific relative axial positions, said mechanism comprising

a tooth-and-groove formation on the exterior surface of the inner member, the teeth and grooves of the formation extending in the circumferential direction and the formation having an axial extent which determines the range of specific relative axial positions in which the members can be locked,

an aperture extending through the thickness of the outer member at a location thereon which exposes part of the formation in each relative axial position of the members throughout said range,

a locking element releasably inserted into the

aperture and having a tooth-and-groove surface which engages with the exposed part of the formation,

and a sleeve axially movable over the outer surface of the outer member to overlie the aperture and to retain the element in the aperture,

wherein the dimensions of the locking mechanism are such that, in use, the locking element is held against the inner member by the sleeve and is held against axial movement by the walls of the aperture, and the pitch of the teeth in the formation determine the specific relative axial positions in which the inner and outer members can be locked.

Preferably the members are screw-threaded together so that relative rotation of the members effects relative axial positional adjustment and the pitch of the screw threads is substantially greater than the pitch of the teeth in the formation.

Preferably the aperture in the outer member is in the form of a slot extending circumferentially to a greater extent than the locking element to facilitate insertion and removal of the element.

Preferably the sleeve is mounted on the outer surface of one of the members by screw threads and is rotatable into and out of its position overlying the aperture. Alternatively, the sleeve may be axially slidable on the outer surface of one of the members. Sleeve-securing means is preferably provided to secure the sleeve to the

one member when in its element-retaining position.

Preferably the inner member protrudes from one end of the outer member, the aperture is located adjacent said one end, and the sleeve is mounted on the protruding portion of the inner member and has a projecting portion capable of overlying the aperture.

Conveniently the aperture adjacent said one end is disposed in a portion of the outer member which is of reduced thickness and uniform outer dimensions of the tool are restored by the thickness of the projecting sleeve portion.

The inner member of the tool may be hollow or solid and the tooth profile of the formation may be any convenient shape such as vee shaped or castellated.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawing, in which:

Fig. 1 is a sectional side view of part of a tool having a locking mechanism for locking overlapping members;

Fig. 2 illustrates the locking mechanism in greater detail with the upper half of the drawing showing the members in a different relative axial position from that of the lower half of the drawing;

Fig. 3 shows three views of the locking element of the mechanism; and

Fig. 4 schematically illustrates the locking action of the mechanism.

The tool 1 shown in Fig. 1 has inner and outer members 2,3 which are co-axial about the longitudinal axis 4 of the tool. To accommodate inner member 2 the outer member 3 is tubular but the inner member 2 may be either tubular or solid. For downhole operations inner member 2 is usually tubular as illustrated. Members, 2,3 are interconnected by screw-threading 5 so that relative rotation of the members produces relative axial positional adjustment. The interconnection however need not be screw-threading but could be by way of splines or even un-profiled bearing surfaces. A locking mechanism 6 is provided for locking the members 2,3 in any one of a number of specific relative axial positions.

Fig. 2 shows mechanism 6 in greater detail (for two different positions of the members 2,3) as comprising a tooth-and-groove formation 8 on the exterior surface of member 2, an aperture 9 extending through the thickness of member 3 to expose part of the formation 8, an element 10 which can be releasably inserted into the aperture 9 to engage with the exposed part of the formation 8, and a sleeve 11 which is axially movable to overlie the aperture 9 and retain the element 10 in place.

Formation 8 has its teeth and grooves extending in the circumferential direction and straight grooves are preferred. The axial length of the formation 8 is such that throughout the desired range of movement of the members 2,3 part of the formation 8 is exposed beneath the

aperture 9 so that the axial length of the formation 8 determines the range of specific relative axial positions in which the members 2,3 can be locked. The aperture 9 is conveniently in the form of an arcuate slot formed in the outer member 3 and extending in the circumferential direction whilst the locking element 10 is an arcuate segment, as shown in Fig. 3, which has an axial width dimensioned to be a sliding fit into and out of the aperture 9. The circumferential extent of the element 10 is preferably less than that of the aperture 9 to ease insertion and removal of the element 10 by hand. For example the element 10 may have an arcuate extent of 90° and the slot aperture may extend to 120°. The inner surface 10A of element 10 is provided with a tooth-and-groove profile which matches that of formation 8 so that the element 10 can engage the inner member 2 and be held against axial movement by the parts of the outer member 3 which form the circumferentially extending walls of the aperture 9. The thickness of the element 10 is dimensioned so that when it is properly seated and engaging the formation 8 its outer surface 10B is in abutment with the sleeve 11 so that the element 10 is prevented from movement in the radial direction. The pitch of the teeth in formation 8 determine the specific positions in which the members 2,3 can be locked and for this reason this pitch is substantially less than the pitch of the screw-threading 5. This arises because

element 10 and aperture 9 are dimensioned to avoid relative movement in the axial direction so that element 10 can only seat properly on formation 8, thereby allowing sleeve 11 to function as an element retainer, when the exposed teeth and grooves of the formation 8 are in a particular position with respect to the aperture 9.

Sleeve 11 in this embodiment is mounted by screw-threading 12 to a part of inner member 2 which protrudes beyond the end 3A of outer member 3 and has a projecting portion 11A which overlies the aperture 9. Aperture 9 is formed in a portion 3B of outer member 3 adjacent end 3A which is of reduced thickness and the uniform outer dimension of the tool 1 is restored by the thickness of projecting portion 11A. The sleeve 11 is securable to the inner member 2 by a pin or screw at 13 when the sleeve is in its element-retaining position.

Fig. 4 schematically illustrates the locking action of the mechanism 6 when the tooth profile of formation 8 is V-shaped (as is that on element 10). Thus, any tendency for relative axial movement between members 2,3 permitted by the element 10 being axially undersided with respect to the aperture 9 creates an outward force F on the element 10 by virtue of the intervention of inclined surfaces of mating teeth so that element 10 is forced outwardly against the sleeve 11 to the extent permitted by the element 10 being radially undersized with respect to the sleeve 11.

CLAIMS

1. A tool having inner and outer co-axial members which are mounted so as to permit relative axial positional adjustment, comprising a mechanism for locking the members of the tool in any one of a number of specific relative axial positions, said mechanism comprising

a tooth-and-groove formation on the exterior surface of the inner member, the teeth and grooves of the formation extending in the circumferential direction and the formation having an axial extent which determines the range of specific relative axial positions in which the members can be locked,

an aperture extending through the thickness of the outer member at a location thereon which exposes part of the formation in each relative axial position of the members throughout said range,

a locking element releasably inserted into the aperture and having a tooth-and-groove surface which engages with the exposed part of the formation,

and a sleeve axially movable over the outer surface of the outer member to overlie the aperture and to retain the element in the aperture,

wherein the dimensions of the locking mechanism are such that, in use, the locking element is held against the inner member by the sleeve and is held against axial movement by the walls of the aperture, and the pitch of

the teeth in the formation determine the specific relative axial positions in which the inner and outer members can be locked.

2. A tool as claimed in claim 1, wherein the members are screw-threaded together so that relative rotation of the members effects relative axial positional adjustment and the pitch of the screw threads is substantially greater than the pitch of the teeth in the formation.

3. A tool as claimed in either preceding claim, wherein the aperture in the outer member is in the form of a slot extending circumferentially to a greater extent than the locking element to facilitate insertion and removal of the element.

4. A tool as claimed in any preceding claim, wherein the sleeve is mounted on the outer surface of one of the members by screw threads and is rotatable into and out of its position overlying the aperture.

5. A tool as claimed in any one of claims 1-3, wherein the sleeve is axially slidable on the outer surface of one of the members.

6. A tool as claimed in claim 4 or claim 5, wherein releasable sleeve-securing means is provided to secure the

sleeve to the one member when in its element retaining position.

7. A tool as claimed in any preceding claim, wherein the inner member protrudes from one end of the outer member, the aperture is located adjacent said one end, and the sleeve is mounted on the protruding portion of the inner member and has a projecting portion capable of overlying the aperture.

8. A tool as claimed in Claim 7, wherein the aperture adjacent said one end is disposed in a portion of the outer member which is of reduced thickness and uniform outer dimensions of the tool are restored by the thickness of the projecting sleeve portion.

9. A tool as claimed in claim 1 and substantially as hereinbefore described with reference to the accompanying drawing.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
9206388.2

Relevant Technical fields

(i) UK Cl (Edition K) E2A (ACMF)

(ii) Int CL (Edition 5) F16B 7/00 7/10 7/14 7/22; F16L 21/00 21/08 27/12 37/00 37/08 37/12; E21B 31/107

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Search Examiner
J D WILSON

Date of Search
8 JULY 1992

Documents considered relevant following a search in respect of claims ALL

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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Category	Identity of document and relevant passages	Relevant to claim(s)

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